

UAS Power Amplifier for Extended Range of Non-Payload Communication Devices (UPEND), Phase II

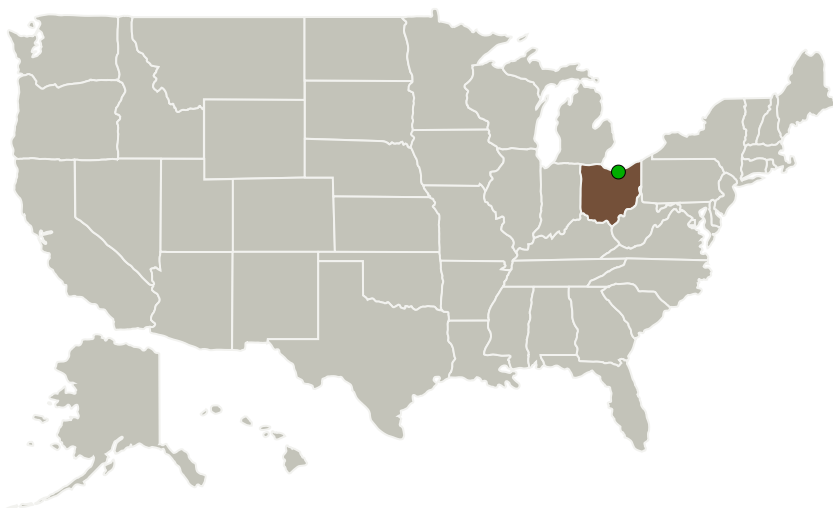
Completed Technology Project (2015 - 2017)



Project Introduction

The high-efficiency and linear UPEND RF C-band power amplifier was designed, simulated and partially prototyped in Phase I to provide range extension for the NASA/Rockwell Collins Control and Non-Payload Communication (CNPC) program's transceiver in support of NAS integration of UAS. UPEND leverages state-of-the-art analog pre-distortion linearization and Doherty power amplifier circuits, MMIC technology, and module-level power efficiency and thermal design, to minimize size, weight, and power consumption (SWaP) of the connectorized PA module, while maintaining the linear output required by amplitude modulation. The UPEND model achieved significant improvement in Error Vector Magnitude (EVM) and power efficiency, while the proof-of-concept prototype provided validation for the model with respect to EVM performance improvement with linearization. In Phase II NuWaves will address the needs of both amplitude-modulated and constant-envelope waveforms by developing multiple MMICs and packaging them together as needed. Separate die will be fabricated for the Doherty amplifier and the linearizer circuits, wire bonded and packaged into two different component-level integrated circuits – one with and one without the linearizer. Two different connectorized PA module variants will be developed using these two component-level ICs, adding the necessary power supply circuitry, supporting circuitry, and mechanical and thermal design to address different NASA and commercial market needs.

Primary U.S. Work Locations and Key Partners



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| Organizations Performing Work | Role | Type | Location |
|-------------------------------|-------------------------|-------------|------------------|
| Nu Waves Ltd. | Lead Organization | Industry | Middletown, Ohio |
| ● Glenn Research Center(GRC) | Supporting Organization | NASA Center | Cleveland, Ohio |

Primary U.S. Work Locations

Ohio

Project Transitions

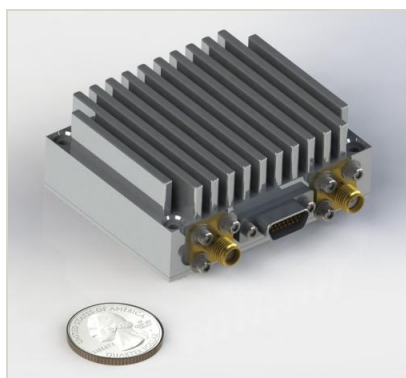
▶ **May 2015:** Project Start

✓ **September 2017:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/140723>)

Images



Briefing Chart

UAS Power Amplifier for Extended Range of Non-Payload Communication Devices (UPEND) Briefing Chart
(<https://techport.nasa.gov/image/125866>)



Final Summary Chart Image

UAS Power Amplifier for Extended Range of Non-Payload Communication Devices (UPEND), Phase II Project Image
(<https://techport.nasa.gov/image/134873>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nu Waves Ltd.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

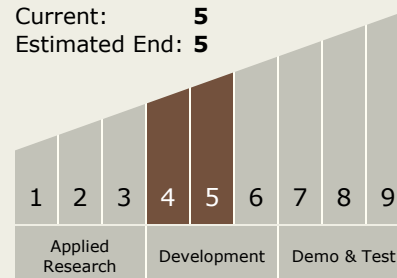
Carlos Torrez

Principal Investigator:

Tim Wurth

Technology Maturity (TRL)

Start: 4
Current: 5
Estimated End: 5



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
 - └ TX05.2 Radio Frequency
 - └ TX05.2.2 Power-Efficiency

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System